Appendix A:

Aircraft Systems -- Work Breakdown Structure and Definitions

A.1 -- Scope

This appendix provides the aircraft system work breakdown structure. Definitions for the aircraft air vehicle are provided in this appendix. Definitions for WBS elements common to all defense materiel items are given in Appendix H: Work Breakdown Structure Definitions, Common Elements.

A.2 -- Applicable Documents

Non-Government Publications.

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

American National Standards Institute (ANSI)

ANSI/IEEE STD 610.12, *Standard Glossary of Software Engineering Terminology*

(Application for copies should be addressed to ANSI Customer Service, 11 West 42nd Street, New York, NY 10036.)

A.3 -- Work Breakdown Structure Levels

Level 1	Level 2	Level 3
Aircraft System	Air Vehicle (AV)	Airframe Propulsion AV Applications Software AV System Software Communications/Identification Navigation/Guidance Central Computer Fire Control Data Display and Controls Survivability Reconnaissance Automatic Flight Control Central Integrated Checkout Antisubmarine Warfare

	Armament
	Weapons Delivery
	Auxiliary Equipment
Sys Engineering/Program Management	
System Test and Evaluation	
	Development Test and Evaluation
	Operational Test and Evaluation
	Mock-ups
	Test and Evaluation Support
	Test Facilities
Training	
	Equipment
	Services
	Facilities
Data	
	Technical Publications
	Engineering Data
	Management Data
	Support Data
	Data Depository
Peculiar Support Equipment	
	Test and Measurement Equipment
	Support and Handling Equipment
Common Support Equipment	
	Test and Measurement Equipment
	Support and Handling Equipment
Operational/Site Activation	
	System Assembly, Installation and Checkout on Site
	Contractor Technical Support
	Site Construction
	Site/Ship/Vehicle Conversion

A.4 -- Definitions

A.4.1 -- Aircraft System

The complex of equipment (hardware/software), data, services, and facilities required to develop and produce air vehicles.

Includes:

- those employing fixed, movable, rotary, or compound wing
- those manned/unmanned air vehicles designed for powered or unpowered (glider) guided flight

A.4.2 -- Air Vehicle

The complete flying aircraft.

Includes:

- airframe, propulsion, and all other installed equipment
- design, development, and production of complete units -- prototype and operationally configured units which satisfy the requirements of their applicable specifications, regardless of end use
- Sub-elements to the air vehicle (A.4.2.1 -- A.4.2.17)

A.4.2.1 -- Airframe

The assembled structural and aerodynamic components of the air vehicle that support subsystems essential to designated mission requirements.

Includes, for example:

- basic structure -- wing, empennage, fuselage, and associated manual flight control system

- rotary wing pylons, air induction system, thrust reversers, thrust vector devices, starters, exhausts, fuel management, inlet control system
- alighting gear -- tires, tubes, wheels, brakes, hydraulics, etc.
- secondary power, furnishings -- crew, cargo, passenger, troop, etc.
- instruments -- flight, navigation, engine, etc.
- environmental control, life support and personal equipment, racks, mounts, intersystem cables and distribution boxes, etc., which are inherent to, and nonseparable from, the assembled structure
- dynamic systems -- transmissions, gear boxes, propellers, if not furnished as an integral part of the propulsion unit
- rotor group and other equipment homogeneous to the airframe

In addition to the airframe structure and subsystems, this element includes:

1) Integration, assembly, test, and checkout:

Includes:

- all efforts as identified in Appendix H: Work Breakdown Structure Definitions, Common Elements, to provide the integration, assembly, test, and checkout of all elements into the airframe to form the air vehicle as a whole
- all administrative and technical engineering labor to perform integration of level 3 air vehicle and airframe elements; development of engineering layouts; determination of overall design characteristics, and determination of requirements of design review
    - overall air vehicle design and producibility engineering
    - detailed production design; acoustic and noise analysis
    - loads analysis; stress analysis on interfacing airframe elements and all subsystems
    - design maintenance effort and development of functional test procedures
    - coordination of engineering master drawings and consultation with test and manufacturing groups
    - tooling planning, design, and fabrication of basic and rate tools and functional test equipments, as well as the maintenance of such equipment
    - production scheduling and expediting

- •• joining or installation of structures such as racks, mounts, etc.
- •• installation of seats, wiring ducting, engines, and miscellaneous equipment and painting
- •• set up, conduct, and review of testing assembled components or subsystems prior to installation

- all effort associated with the installation, integration, test, and checkout of the avionic systems into the air vehicle including:

- •• design of installation plans
- •• quality assurance planning and control including material inspection
- •• installation
- •• recurring verification tests
- •• integration with nonavionics airframe subsystems

- ground checkout prior to flight test; production acceptance testing and service review; quality assurance activities and the cost of raw materials, purchased parts, and purchased equipment associated with integration and assembly

2) Nonrecurring avionics system integration which is associated with the individual avionics equipment boxes and avionics software in a functioning system.

Includes:

- the labor required to analyze, design, and develop avionics suite interfaces and establish interface compatibility with non-avionics support equipment systems, aircraft systems, and mission planning systems
- drawing preparation and establishment of avionics interface equipment requirements and specifications
- technical liaison and coordination with the military service, subcontractors, associated contractors, and test groups

Excludes:

- development, testing, and integration of software (which should be included in air vehicle applications and system software)
- avionics system testing (included in System Test and Evaluation) and aircraft systems engineering efforts (included in Systems Engineering/Program Management).
- all effort directly associated with the remaining level 3 WBS elements

A.4.2.2 -- Propulsion

That portion of the air vehicle that pertains to installed equipment (propulsion unit and other propulsion) to provide power/thrust to propel the aircraft through all phases of powered flight.

Includes, for example:

- the engine as a propulsion unit within itself (e.g., reciprocating, turbo with or without afterburner, or other type propulsion) suitable for integration with the airframe
- thrust reversers, thrust vector devices, transmissions, gear boxes, and engine control units, if furnished as integral to the propulsion unit
- other propulsion equipment required in addition to the engine but not furnished as an integral part of the engine, such as booster units
- the design, development, production, and assembly efforts to provide the propulsion unit as an entity

Excludes:

- all effort directly associated with the elements and the integration, assembly, test, and checkout of these elements into the air vehicle
- all ancillary equipments that are not an integral part of the engine required to provide an operational primary power source -- air inlets, instruments, controls, etc.

A.4.2.3 -- Air Vehicle Applications Software

Includes, for example:

- all the software that is specifically produced for the functional use of a computer system or multiplex data base in the air vehicle
- all effort required to design, develop, integrate, and checkout the air vehicle applications Computer Software Configuration Items (CSCIs)

Excludes:

- the non-software portion of air vehicle firmware development and production (ref. ANSI/IEEE Std 610.12)
- software that is an integral part of any specific subsystem and software that is related to other WBS level 2 elements

Note 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

A.4.2.4 -- Air Vehicle System Software

That software designed for a specific computer system or family of computer systems to facilitate the operation and maintenance of the computer system and associated programs for the air vehicle.

Includes, for example:

- operating systems -- software that controls the execution of programs
- compilers -- computer programs used to translate higher order language programs into relocatable or absolute machine code equivalents
- utilities -- computer programs or routines designed to perform the general support function required by other application software, by the operating system, or by system users (ref. ANSI/IEEE Std 610.12)
- all effort required to design, develop, integrate, and checkout the air vehicle system software including all software developed to support any air vehicle applications software development
- air vehicle system software required to facilitate development, integration, and maintenance of any air vehicle software build and CSCI

Excludes:

- all software that is an integral part of any specific subsystem specification or specifically designed and developed for system test and evaluation
- software that is an integral part of any specific subsystem, and software that is related to other WBS level 2 elements

Note 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

A.4.2.5 -- Communications/Identification

That equipment (hardware/software) installed in the air vehicle for communications and identification purposes.

Includes, for example:

- intercoms, radio system(s), identification equipment (IFF), data links, and control boxes associated with the specific equipment
- integral communication, navigation, and identification package (if used)

Note 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.

A.4.2.6 -- Navigation/Guidance

That equipment (hardware/software) installed in the air vehicle to perform the navigational guidance function.

Includes:

- radar, radio, or other essential navigation equipment, radar altimeter, direction finding set, doppler compass, computer, and other equipment homogeneous to the navigation/guidance function

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.7 -- Central Computer

The master data processing unit(s) responsible for coordinating and directing the major avionic mission systems.

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.8 -- Fire Control

That equipment (hardware/software) installed in the air vehicle which provides the intelligence necessary for weapons delivery such as bombing, launching, and firing.

Includes, for example:

- radars and other sensors including radomes
- apertures/antennas, if integral to the fire control system, necessary for search, target identification, rendezvous and/or tracking
- self-contained navigation and air data systems
- dedicated displays, scopes, or sights
- bombing computer and control and safety devices

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.9 -- Data Display and Controls

The equipment (hardware/software) which visually presents processed data by specially designed electronic devices through interconnection (on-or off-line) with computer or component equipment and the associated equipment needed to control the presentation of the data necessary flight and tactical information to the crew for efficient management of the aircraft during all segments of the mission profile under day and night all-weather conditions.

Includes, for example:

- multi-function displays, control display units, display processors, and on-board mission planning systems

Excludes:

- indicators and instruments not controlled by keyboard via the multiplex data bus and panels and consoles which are included under the airframe

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.10 -- Survivability

Those equipments (hardware/software) installed in, or attached to, the air vehicle which assist in penetration for mission accomplishment.

Includes, for example:

- ferret and search receivers, warning devices and other electronic devices, electronic countermeasures, jamming transmitters, chaff, infra-red jammers, terrain-following radar, and other devices typical of this mission function

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.11 -- Reconnaissance

Those equipments (hardware/software) installed in, or attached to, the air vehicle necessary to the reconnaissance mission.

Includes, for example:

- photographic, electronic, infrared, and other sensors
- search receivers
- recorders
- warning devices
- magazines
- data link

Excludes:

- gun cameras

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.12 -- Automatic Flight Control

Those electronic devices and sensors, which, in combination with the flight controls subsystem (under airframe), enable the crew to control the flight path of the aircraft and provide lift, drag, trim, or conversion effects.

Includes, for example:

- flight control computers, software, signal processors, and data transmitting elements that are devoted to processing data for either primary or automatic flight control functions

- electronic devices required for signal processing, data formatting, and interfacing between the flight control elements; the data buses, optical links, and other elements devoted to transmitting flight control data

- flight control sensors such as pressure transducers, rate gyros, accelerometers, and motion sensors

Excludes:

- devices -- linkages, control surfaces, and actuating devices -- covered under the airframe WBS element
- avionics devices and sensors -- central computers, navigation computers, avionics data buses and navigation sensors -- which are included under other avionics WBS elements

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.13 -- Central Integrated Checkout

That equipment (hardware/software) installed in the air vehicle for malfunction detection and reporting.

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

A.4.2.14 -- Antisubmarine Warfare

That equipment (hardware/software) installed in the air vehicle peculiar to the antisubmarine warfare mission.

Includes, for example:

- sensors, computers, displays, etc.

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle***

is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.

A.4.2.15 -- Armament

That equipment (hardware/software) installed in the air vehicle to provide the firepower functions.

Includes, for example:

- guns, high energy weapons, mounts, turrets, weapon direction equipment, ammunition feed and ejection mechanisms, and gun cameras

Note 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

Note 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.

A.4.2.16 -- Weapons Delivery

That equipment (hardware/software) installed in the air vehicle to provide the weapons delivery capability.

Includes, for example:

- launchers, pods, bomb racks, pylons, integral release mechanisms, and other mechanical or electro-mechanical equipments specifically oriented to the weapons delivery function

Excludes:

- bombing/navigation system (included in the fire control element)

Note 1: If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.

Note 2: All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.

A.4.2.17 -- Auxiliary Equipment

Auxiliary airframe, electronics, and/or armament/weapons delivery equipment not allocable to individual element equipments, or which provides the ancillary functions to the applicable mission equipments.

Includes, for example:

- auxiliary airframe equipment such as external fuel tanks, pods, and rotodomes
- multi-use equipment like antennas, control boxes, power supplies, environmental control, racks, and mountings, not homogeneous to the prescribed WBS elements

Note 1: ***If lower level information can be collected, use the structure and definitions in Appendix B, Electronic/Automated Software Systems.***

Note 2: ***All effort directly associated with the remaining level 3 WBS elements and the integration, assembly, test, and checkout of these elements into the air vehicle is excluded. This item contains embedded software -- software defined in the item specification and provided by the supplier.***

Note 3: ***Auxiliary armament/weapons delivery equipment includes flares and ejection mechanisms, ejector cartridges, and other items peculiar to the mission function that are not identifiable to the armament or weapons delivery elements set forth in A.4.2.15 and A.4.2.16 of this appendix.***

A.4.3 -- Common Elements

WBS Levels 2 and 3. Definitions for common WBS elements applicable to the aircraft as well as all other defense materiel items are in Appendix H: Work Breakdown Structure Definitions, Common Elements.